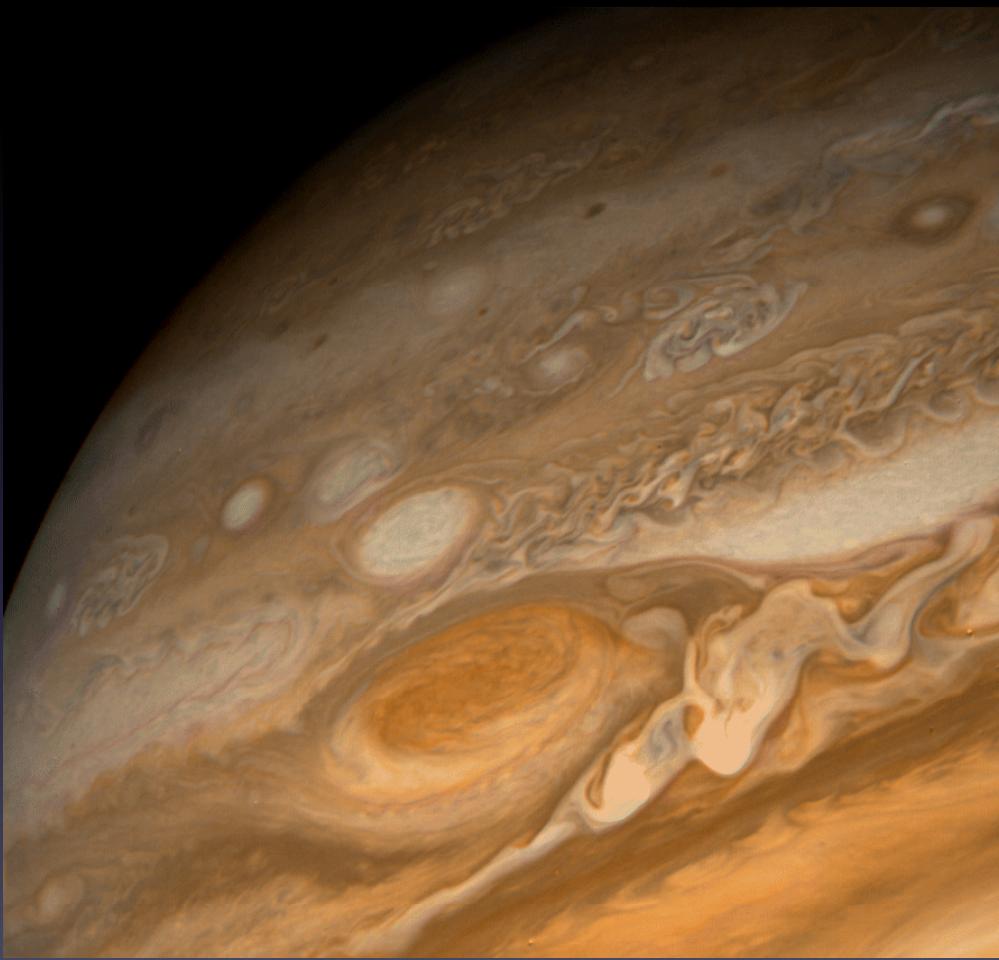


Voyager: Exploring through the Public Eye

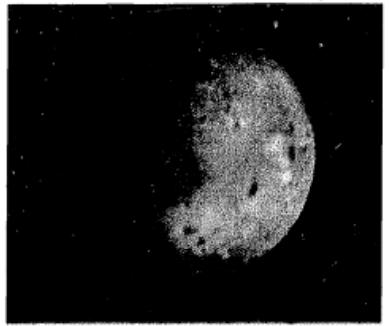
Giny Cheong
George Mason University
September 25, 2012



SCIENCE
ASTRONOMY

Galileo's Spin on Jovian Moons

By Carl Sagan
Washington Post Staff Writer



New images from Jupiter's moon Io (above), taken by the Galileo probe on June 25, show that the face of the planet has been drastically altered by volcanic activity since the last pictures were obtained by the Voyager 1 and 2 spacecraft 17 years ago. The largest of Jupiter's four Galilean satellites, Io has a diameter 92 miles larger than Earth's moon and is about 20 percent more massive. Its predominantly red and orange hues are caused by high concentrations of sulfur. The brightest areas are produced by "snow" and "frost" of sulfur dioxide; darker regions indicate recent volcanic activity.



Ganymede (below left) is the largest satellite in the solar system, about three-fourths the size of Mars and twice the mass of our moon. Its surface is made up of dark-colored polygons separated by white lines that are oriented and tilted with respect to the polygon borders. Scientists now think that pattern reflects stresses in Ganymede's outer crust, which expanded like an inflating balloon, leaving light-colored "stretch marks" in the surface. New images (above left) taken in late June are 20 times more detailed than those obtained by Voyager.

Jupiter



JOVIAN SATELLITES

Jupiter has 16 known moons—all but five of which have been discovered in the past 20 years. They are shown below in descending order of size, not in their orbital order around the giant gas planet. The four largest are called the Galilean moons after Galileo Galilei, the NASA space probe's namesake, who first observed them in 1610.

Jupiter
Ganymede
Callisto
Io
Europa
Amalthea
Himalia
Elara
Metis
Thebe
Adrastea
Pasiphae
Carme
Sinope
Lysithes
Ananke
Leda

SOURCE: NASA

cent greater than water) coalesced; similarly, the outermost of Jupiter's four biggest moons, Ganymede and Callisto, are the least dense.

In fact, those two are composed of half silicate rock and half water ice, and were once presumed to be frozen nearly solid. But if ionospheric electrical activity is causing a magnetic field in Ganymede, it could take place only in molten rock deep in the core—or perhaps in the motion of some kind of electrically conductive slush. Galileo will also map Ganymede's magnetic field, as well as Ganymede's irregular surface topography, which is made up of dark areas separated by bands of lighter material.

Scientists had theorized that the light regions were formed when underlying ice or water expelled by volcanic action welled up and froze into sets of parallel ridges. But the new high resolution images show "very little evidence" for that notion, said Michael Belton of the National Optical Astronomy Observatories in Tucson. Instead, he says, Ganymede's water ice was covered with water that subsided, froze into an ice shell, and remodeled. As the surface area grew, it developed "stretch marks" now visible as lighter terrain. "As the expansion occurred," Belton speculated, "the solid ice mantle fractured, and then faulted and slipped," making the distinctive pattern of parallel ridges.

In addition, the new images imply that the stretching took place over an extended period because some of the lightly colored ridges are far from impact craters that other light areas.

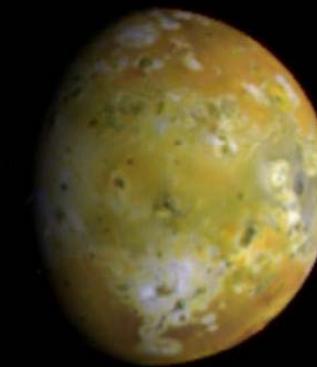
The more craters, the older the surface. According to James Head of Brown University, those revelations "turn our previous thinking upside down."

They also deepen another question the Galileo mission will address: Why are Ganymede and frigid Callisto—which are so similar in size, density, composition and history—so visibly different on the surface?

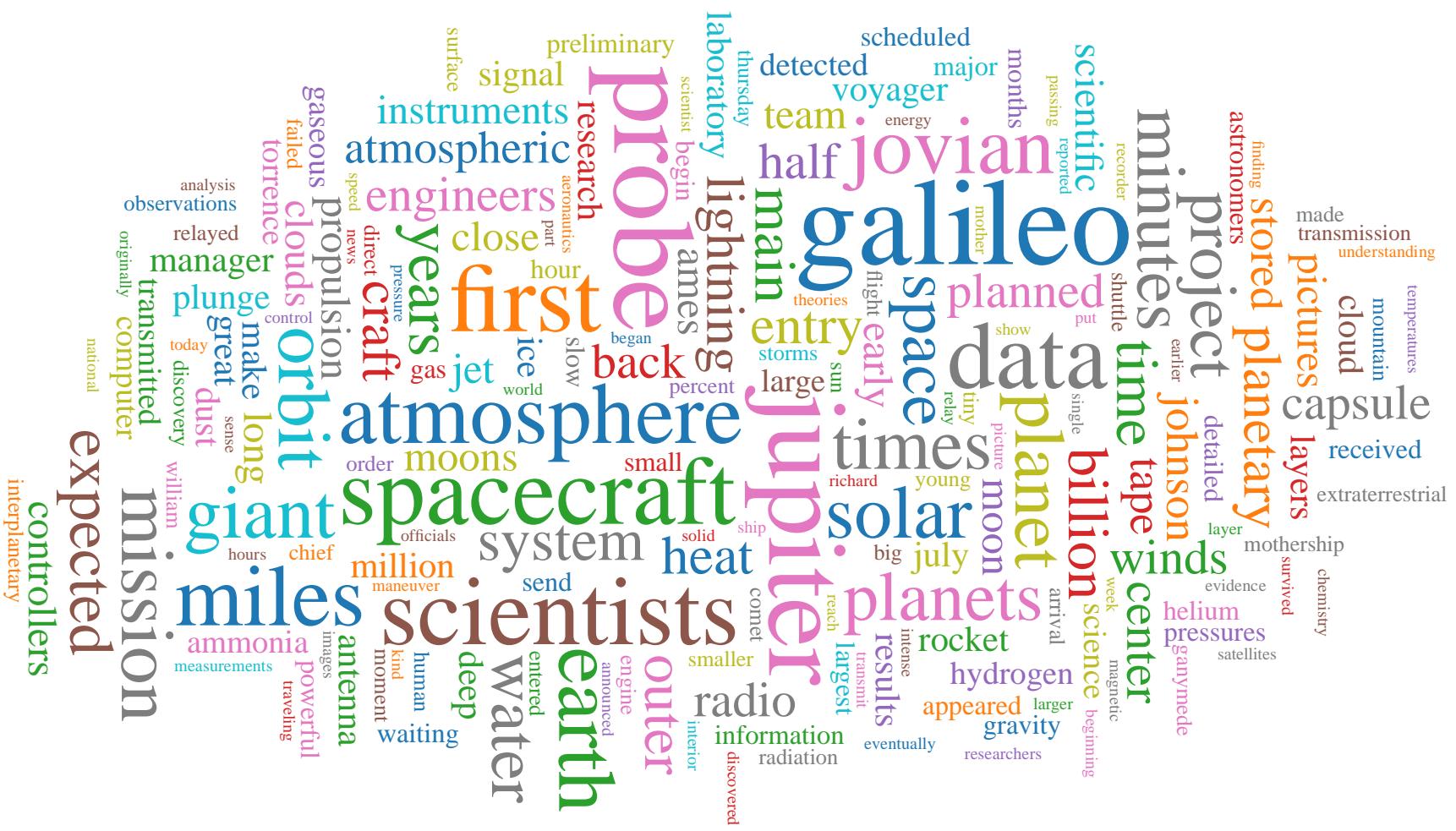
When the Galileo probe also circled in with long suffering Io, torn between Jupiter's enormous gravity and the tug of its sister satellites, Io's rocky core is wracked so hard that frictional heat induces incessant volcanism. And there may be something else going on: Galileo's instruments found that Io, too, puts a small dent in Jupiter's magnetic field. Margaret Kivelson of UCLA and colleagues from the probe's magnetometer team report in the July 19 issue of *Science* that Io, like Ganymede, has a magnetic field.

Ganymede clearly doesn't meet the bar magnet criterion because it's not dense enough. The reason is that the Jovian satellite system evolved pretty much the same way the solar system did some 5 billion years ago. Planets that formed in the torrid environs nearest the sun (Mercury, Venus, Earth and Mars) were too hot to hold on tight to gases and became dense, hard and rocky. Farther out, in the cold reaches of the solar system, Io and Ganymede, far from the sun, lighter substances were less prone to boil off, and gas giants such as Jupiter (with an average density only 30 per-

"Stay tuned," he said. "It's going to be quite a sight."



Galileo Word Cloud



Galileo Word Cloud

ames (13) antenna (23) appeared (10) around (24) arrival (15) atmosphere (63) begin (12) billion (17)
capsule (16) center (16) clouds (30) comet (13) computer (15) controllers (15) craft (22) data (59) dr (20) early (11)
earth (62) engineers (18) entry (17) expected (25) formed (12) **galileo** (138) ganymede (11)
giant (27) gravity (13) half (15) heat (16) helium (13) hour (16) instruments (14) io (18) jet (11) johnson (17) jovian (33)
jupiter (160) known (12) laboratory (14) lightning (18) main (17) manager (11) measurements (10)
miles (41) minutes (30) mission (37) months (16) moons (22) nasa (14) o'neil (21) observations (10)
orbit (43) outer (17) passing (11) pictures (13) **planet** (104) planetary (15) planned (19) plunge (11) powerful (10)
pressure (17) **probe** (124) project (22) propulsion (11) radio (16) received (11) recorder (11) relayed (12) results (13)
rocket (10) scheduled (11) scientific (10) **scientists** (68) send (10) signal (13) six (13) solar (28) space (24)
spacecraft (71) star (11) stored (13) storms (11) sun (22) system (36) tape (14) team (13) temperatures (10)
theory (12) times (28) today (10) transmission (12) transmitted (13) view (10) voyager (12) waiting (11) water (26) week (10) winds (19)
years (37) young (10)

Cassini Word Cloud



Cassini Word Cloud

agency (13) ago (10) already (7) approach (8) around (7) astronomer (8) atmosphere (12) began (11) beginning (8) billion (15) burn (14) cameras (11) cassini-huygens (24) cassini (59) chief (8) closest (7) clouds (9) complex (7) controllers (11) craft (12) data (13) described (6) discovered (6) dr (22) dust (7) earth (16) engine (16) european (11) expected (9) field (7) firing (9) flight (12) forces (6) galileo (7) gap (11) gravity (11) huygens (17) ice (14) images (14) insertion (7) italian (6) jet (7) jones (7) journey (7) jupiter (7) known (8) laboratory (9) largest (7) life (11) magnetic (12) main (10) maneuver (10) miles (20) minutes (7) mission (41) mitchell (10) moon (24) mph (6) nasa (12) nearly (6) object (8) observations (8) operations (6) orbit (49) particles (6) perhaps (12) pictures (15) planet (38) planetary (6) planned (10) porco (17) propulsion (10) provide (6) rings (100) robert (6) rocket (16) saturn (107) saturnian (7) science (8) scientific (7) scientists (33) seven (8) shepherd (6) smaller (6) solar (19) space (31) spacecraft (81) study (8) sun (7) surface (8) system (27) team (12) telescope (7) titan (28) traveling (7) turned (12) voyager (8) webster (7) wide (7) years (25)

